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(54) **SYSTEM AND METHOD FOR PARTIAL SCAN ARTIFACT REDUCTION IN MYOCARDIAL CT PERFUSION**

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(51) **Int. Cl.**

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A61B 6/00	(2006.01)
G06T 11/00	(2006.01)
A61B 6/03	(2006.01)

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

None

See application file for complete search history.

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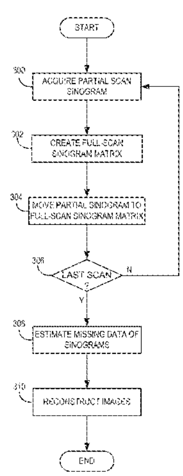
(57) **ABSTRACT**

A system and method is provided for reducing partial scan reconstruction artifacts in sinogram data acquired as a series of sets of partial-scan projection views, each set of projection views extending over an angular range of less than 360 degrees. A full-scan sinogram matrix for each of the sets of projection views in the series is created and each set of partial-scan projection views is stored in a respective full-scan sinogram matrix to create an array of full-scan matrices having respective empty spaces not filled by partial-scan projection view data stored therein. The empty spaces are filled in each of the full-scan sinogram matrices using the partial-scan projection view data stored therein and an image of the subject is reconstructed from the full-scan sinogram matrices having the empty spaces filled using the partial-scan projection view data stored therein.

21 Claims, 4 Drawing Sheets



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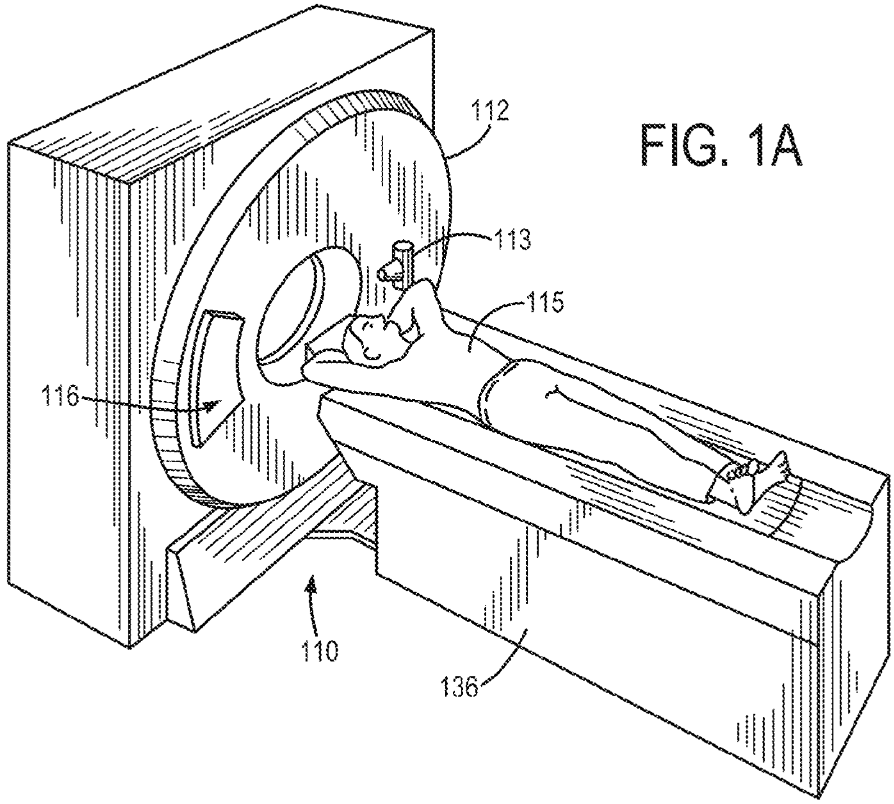

112
113
115
116
110
136

FIG. 1A

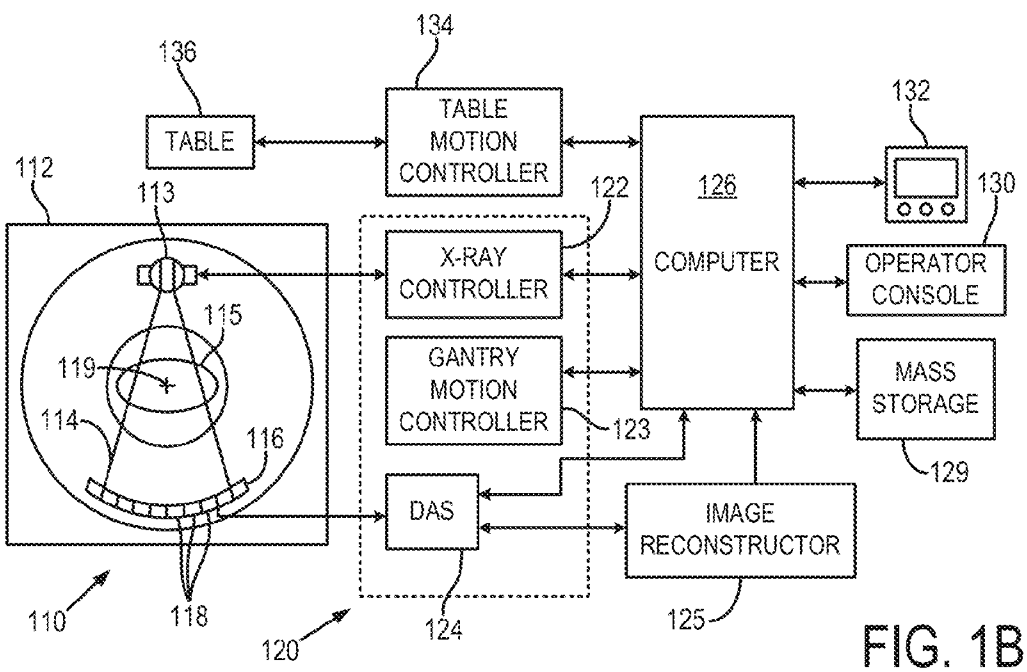
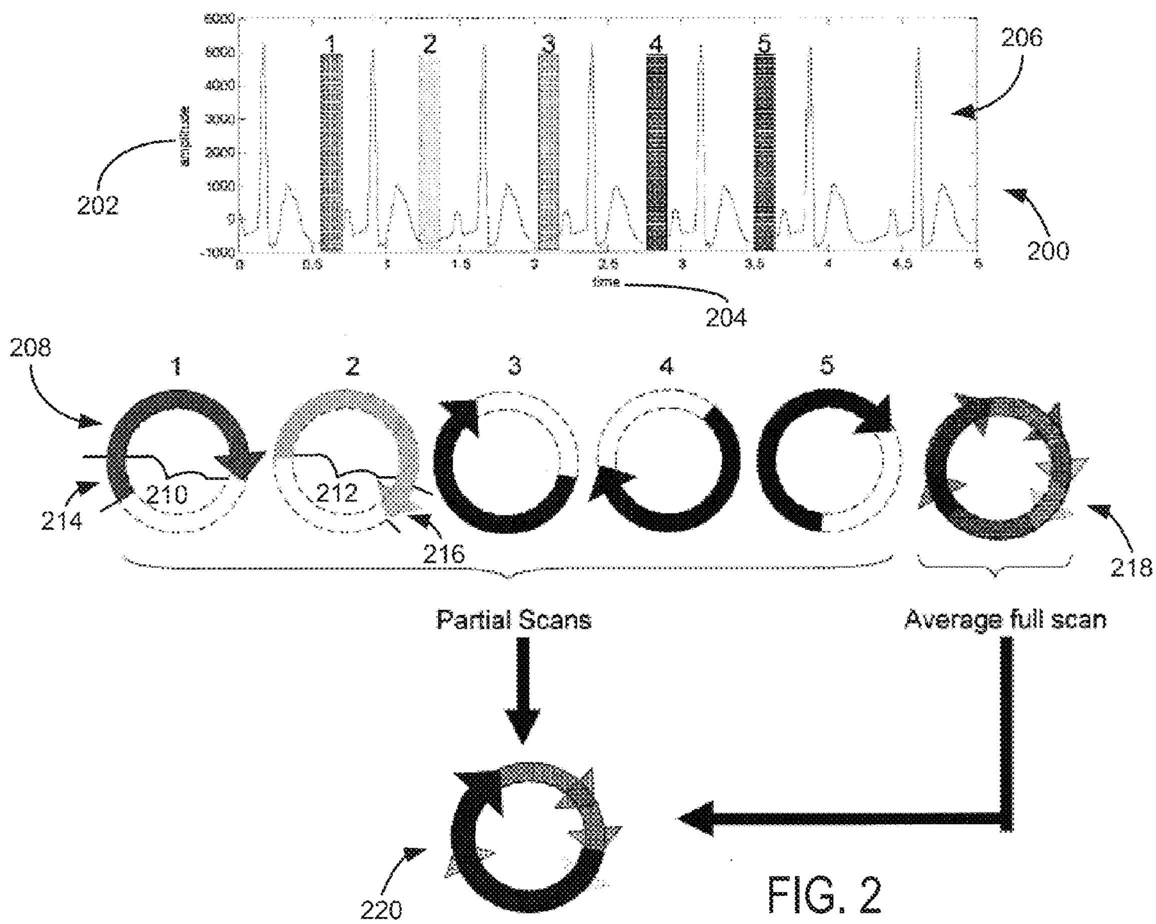

136
TABLE
134
TABLE MOTION CONTROLLER
126
COMPUTER
132
130
OPERATOR CONSOLE
112
113
122
X-RAY CONTROLLER
115
119
114
116
GANTRY MOTION CONTROLLER
123
MASS STORAGE
129
DAS
IMAGE RECONSTRUCTOR
110
118
120
124
125

FIG. 1B



206
202
200
204
amplitude
time
1
2
3
4
5
208
210
212
214
216
218
220
Partial Scans
Average full scan

FIG. 2

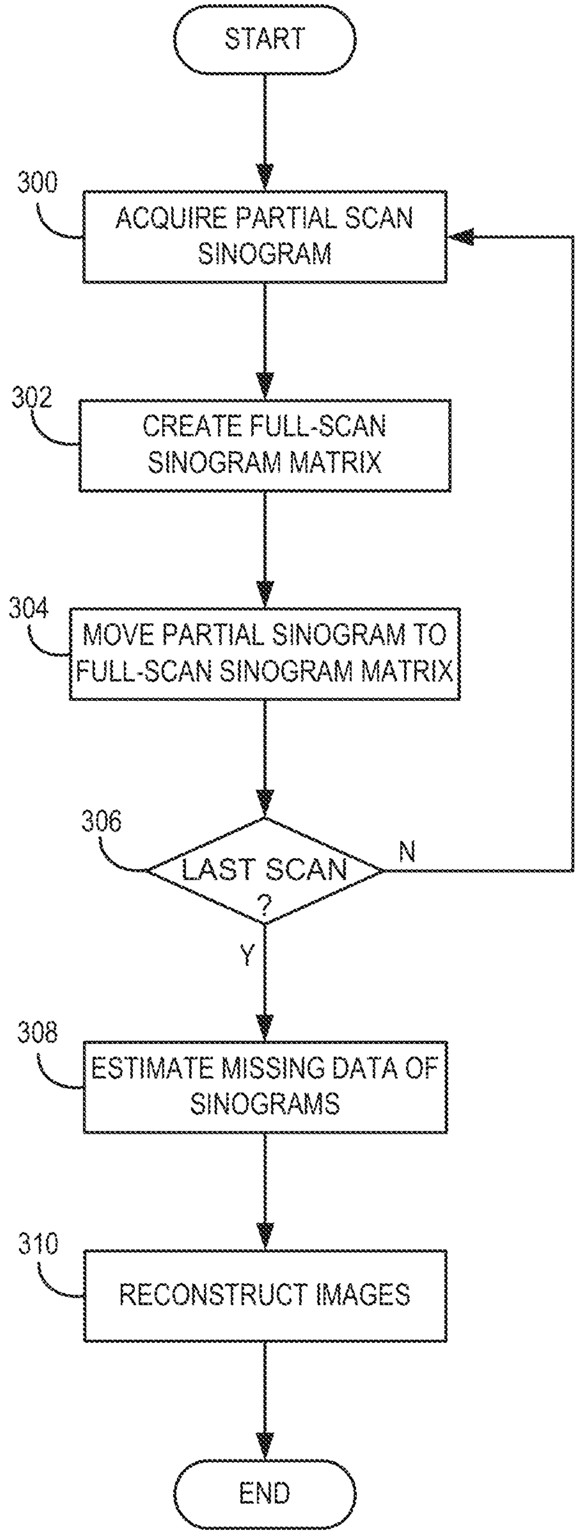

START
300
ACQUIRE PARTIAL SCAN SINOGRAM
302
CREATE FULL-SCAN SINOGRAM MATRIX
304
MOVE PARTIAL SINOGRAM TO FULL-SCAN SINOGRAM MATRIX
306
LAST SCAN ?
N
Y
308
ESTIMATE MISSING DATA OF SINOGRAMS
310
RECONSTRUCT IMAGES
END

FIG. 3

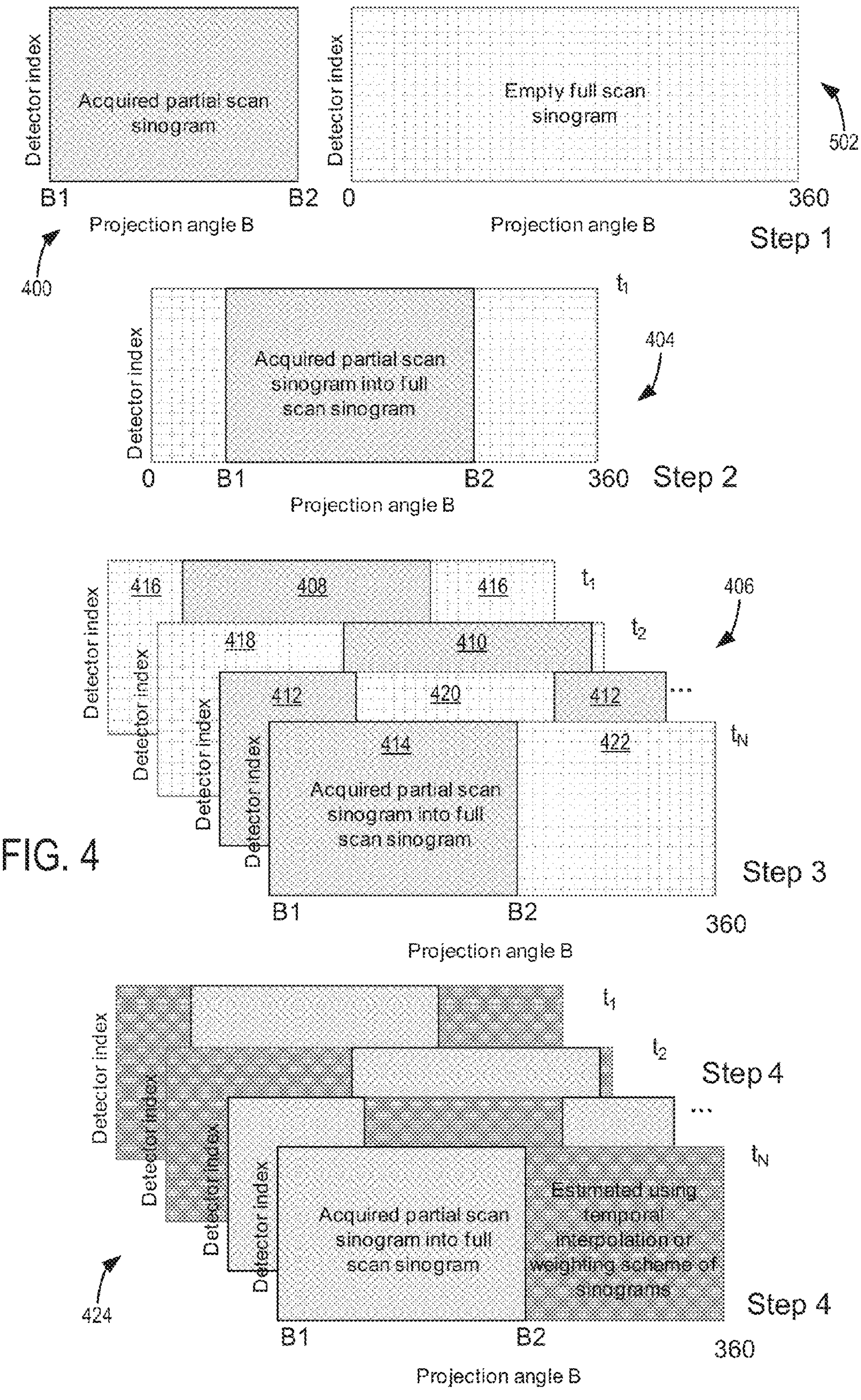

Detector index
Acquired partial scan sinogram
B1
B2
Projection angle B
400
Detector index
Empty full scan sinogram
0
360
Projection angle B
502
Step 1
Detector index
Acquired partial scan sinogram into full scan sinogram
0
B1
B2
360
Projection angle B
404
Step 2
416
408
416
418
410
412
420
412
414
422
406
Acquired partial scan sinogram into full scan sinogram
B1
B2
360
Projection angle B
Step 3
Step 4
Acquired partial scan sinogram into full scan sinogram
Estimated using temporal interpolation or weighting scheme of sinograms
B1
B2
360
Projection angle B
424
Step 4

FIG. 4

SYSTEM AND METHOD FOR PARTIAL SCAN ARTIFACT REDUCTION IN MYOCARDIAL CT PERFUSION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on, claims the benefit of, and incorporates herein by reference U.S. Provisional Patent Application Ser. No. 61/613,475, entitled, filed Mar. 20, 2012, and entitled "SYSTEM AND METHOD FOR PARTIAL SCAN ARTIFACT REDUCTION IN MYOCARDIAL CT PERFUSION" and also U.S. Provisional Patent Application Ser. No. 61/625,415, entitled, filed Apr. 17, 2012, and entitled "SYSTEM AND METHOD FOR PARTIAL SCAN ARTIFACT REDUCTION IN MYOCARDIAL CT PERFUSION"

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

N/A

BACKGROUND OF THE INVENTION

The present invention relates generally to systems and methods for medical imaging and, particularly, to systems and methods for reducing partial scan reconstruction artifacts in computed tomography perfusion (CTP).

In a computed tomography ("CT") system, an x-ray source projects a fan-shaped or cone-shaped beam of x-rays that is collimated to lie within an x-y plane of a Cartesian coordinate system, termed the "imaging plane." The x-ray beam passes through the object being imaged, such as a patient, and impinges upon an array of radiation detectors. The intensity of the transmitted radiation is dependent upon the attenuation of the x-ray beam by the object, and each detector produces a separate electrical signal that is a measurement of the beam attenuation. The attenuation measurements from all of the detectors are acquired separately to produce a transmission profile at a particular view angle.

The source and detector array in a conventional CT system are rotated on a gantry within the imaging plane, and around the object so that the angle at which the x-ray beam intersects the object constantly changes. A group of x-ray attenuation measurements from the detector array at a given angle is referred to as a "view," and a "scan" of the object includes a set of views acquired at different angular orientations during one revolution of the x-ray source and detector, thereby giving rise to the term "view angle" as synonymous with "view" or "projection." In a two dimensional (2D) scan, data is processed to reconstruct an image that corresponds to a slice taken through the object. The prevailing method for reconstructing an image from 2D data is referred to in the art as the filtered backprojection technique. This process converts the attenuation measurements from a scan into integers called "CT numbers," or "Hounsfield units," which are used to control the brightness of a corresponding pixel on a display.

Myocardial CTP is important for evaluating the hemodynamic significance of coronary artery disease. The rapid developments in multidetector row CT, particularly its successful adoption for noninvasive cardiac imaging, raise the possibility of obtaining both anatomic and functional information from a single imaging modality. However, from a technical perspective, cardiac CT is challenging due to demands in temporal resolution. Strategies to improve temporal resolution include faster gantry rotation, dual- and multiple-source CT, and partial (or short) scan reconstructions. In myocardial CTP several consecutive partial scans are used to track the transient arrival and washout of intravascular contrast agent. Since myocardial CTP protocols are typically ECG-gated, according to a desired interval within the cardiac cycle (for example, diastolic phase), it is not possible to guarantee that the same angular data range (or view angles) is covered by each consecutive partial scan. As a consequence, artifactual CT number variations over time, called partial scan reconstruction artifacts (PSR artifacts or PSAs), arise due to minor deviations in the projection data due to physical effects, for example, such as scattering and beam hardening.

Solutions proposed to address PSAs include an invasive procedure in which the animal heart is paced in synchrony with the gantry rotation of a CT scanner, thus guaranteeing consistent angular ranges for each partial scan. This results in effective reduction or elimination of artifacts. However, the obvious disadvantage of such an approach is its invasiveness, which precludes its use in humans. More recently, two non-invasive methods to reduce PSAs have been proposed. The first uses a special data acquisition mode in which x-rays are applied to complete a full gantry rotation (full scan with 360 degrees of projection data). Then, based on the ECG signal, a specific phase of the cardiac cycle is selected and both a full and a partial scan are reconstructed. And by the use of convolution operations, a new image dataset containing the low spatial frequencies portion from a full scan (with no PSAs) and high spatial frequencies from a partial scan (free from motion artifact) is obtained. Such an approach is called the "targeted spatial frequency filter" (TSFF), and is currently implemented in the second generation dual source CT scanner (Somatom Definition Flash, Siemens Healthcare). A disadvantage of this approach is an increase in radiation dose (for example, 14%), and potential decreases in temporal resolution compared to a partial scan.

Another approach to PSAs was proposed by Stenner et al. (2010). In this approach, only partial scans from a myocardial CTP sequence are used. In this approach, the raw data of several consecutive partial scans are averaged such that a sinogram containing 360 degrees of projection data (a full scan) is created. This is referred to as the "artificial full scan sinogram." Then, a virtual partial scan sinogram is extracted from the artificial full scan sinogram, by selecting the projection data corresponding to an angular range identical to that of the acquired partial scan sinogram. Then, three image datasets are reconstructed from each corresponding sinogram. The last operation consists in subtracting the virtual scan image from the artificial scan image, leaving as a result the 'artifact' image. Then, the 'artifact image' is substrated from the original partial scan image resulting in a partial scan image free from artifact. Advantages of this method include that it is noninvasive, there is no added radiation dose, and temporal resolution is preserved. A disadvantage is that the method requires several image reconstruction steps (3 instead of 1); hence, computational requirements are increased at least threefold. Another disadvantage is that, in practice, the superposition operations are potentially error prone because of mismatches generated by motion artifacts due to the rapid heart motion, that is, when applying this technique in vivo.

Therefore, it would be desirable to have a system and method for the reduction or control of PSAs in CTP that is substantially non-invasive, that does not increase radiation dose, that preserves temporal resolution, and that is robust to motion artifacts. Additionally, it would be desirable to have a system and method for PSAs reduction that can be readily applied to existing myocardial CTP protocols available in commercial CT scanners.

SUMMARY OF THE INVENTION

The present invention overcomes the aforementioned drawback by providing a system and method for processing and reconstructing partial-scan data acquired by a CT system without the need to use specialized hardware, introduce additional dose to the patient, or endure burdensome computations. Rather, the present disclosure provides a system and method for transforming partial-scan sinogram data into full-scan sinogram data and reconstructing images form the full-scan sinogram data, without the drawbacks of traditional methods for overcoming PSAs described above.

In accordance with one aspect of the disclosure, a method for producing images of a subject acquired during subject motion using a medical imaging system and partial scan trajectories is provided. The method includes acquiring sinogram data of a subject formed as a series of sets of partial-scan projection views, each set of projection views extending over an angular range of less than 360 degrees from an initial view angle to a end view angle. The method also includes creating a full-scan sinogram matrix for each of the sets of projection views in the series and storing each set of partial-scan projection views in a respective full-scan sinogram matrix to create an array of full-scan matrices having respective empty spaces not filled by partial-scan projection view data stored therein. The method further includes filling the empty spaces in each of the full-scan sinogram matrices using the partial-scan projection view data stored therein and reconstructing an image of the subject from the full-scan sinogram matrices having the empty spaces filled using the partial-scan projection view data stored therein.

In accordance with another aspect of the disclosure, a computed tomography (CT) imaging system is disclosed that includes an x-ray source configured to emit x-rays toward an object to be imaged, a detector configured to receive x-rays that are attenuated by the object, and a data acquisition system (DAS) connected to the detector to receive an indication of received x-rays. The system also includes a computer system coupled to the x-ray source and DAS and programmed to control the x-ray source, detector, and DAS to acquire sinogram data of the object as a series of sets of partial-scan projection views, each set of projection views extending over an angular range of less than 360 degrees. The computer system is also programmed to create a full-scan sinogram matrix for each of the sets of projection views in the series and store each set of partial-scan projection views in a respective full-scan sinogram matrix to create an array of full-scan matrices having respective empty spaces not filled by partial-scan projection view data stored therein. The computer is further programmed to fill the empty spaces in each of the full-scan sinogram matrices using the partial-scan projection view data stored therein and reconstruct an image of the subject from the full-scan sinogram matrices having the empty spaces filled using the partial-scan projection view data stored therein.

In accordance with yet another aspect of the disclosure, a method for reducing partial scan reconstruction artifacts in computed tomography images acquired during subject motion using partial scan trajectories is provided. The method includes obtaining at least one set of medical imaging projection data from a subject undergoing motion using partial computed tomography scans having an associated angular range and storing the at least one set of medical imaging projection data in a matrix arranged according to view angle. The method also includes estimating medical imaging projection data in view angles outside the angular range covered by each partial computed tomography scan using at least one of a weighting and an interpolation based on the medical imaging projection data from neighboring partial computed tomography scans.

The foregoing and other aspects and advantages of the invention will appear from the following description. In the description, reference is made to the accompanying drawings which form a part hereof, and in which there is shown by way of illustration a preferred embodiment of the invention. Such embodiment does not necessarily represent the full scope of the invention, however, and reference is made therefore to the claims and herein for interpreting the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a pictorial view of an x-ray computed tomography (CT) imaging system for use with the present disclosure.

FIG. **1**B is a block diagram of the CT imaging system of FIG. **1**A.

FIG. **2** is a diagram of partial CT image scans combined according to methods of the present disclosure.

FIGS. **3** is a flow chart setting forth steps of an exemplary process in accordance with the present disclosure.

FIG. **4** is a schematic illustration of a process in accordance with the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

With initial reference to FIGS. **1**A and **1**B, an x-ray computed tomography ("CT") imaging system **110** includes a gantry **112** representative of a "third generation" CT scanner. Gantry **112** has an x-ray source **113** that projects a fan-beam, or cone-beam, of x-rays **114** toward a detector array **116** on the opposite side of the gantry. The detector array **116** is formed by a number of detector elements **118** which together sense the projected x-rays that pass through a medical patient **115**. Each detector element **118** produces an electrical signal that represents the intensity of an impinging x-ray beam and hence the attenuation of the beam as it passes through the patient. During a scan to acquire x-ray projection data, the gantry **112** and the components mounted thereon rotate about a center of rotation **119** located within the patient **115**.

The rotation of the gantry and the operation of the x-ray source **113** are governed by a control mechanism **120** of the CT system. The control mechanism **120** includes an x-ray controller **122** that provides power and timing signals to the x-ray source **113** and a gantry motor controller **123** that controls the rotational speed and position of the gantry **112**. A data acquisition system ("DAS") **124** in the control mechanism **120** samples analog data from detector elements **118** and converts the data to digital signals for subsequent processing. An image reconstructor **125**, receives sampled and digitized x-ray data from the DAS **124** and performs high speed image reconstruction. The reconstructed image is applied as an input to a computer **126** which stores the image in a mass storage device **128**.

The computer **126** also receives commands and scanning parameters from an operator via console **130** that has a keyboard. An associated display **132** allows the operator to observe the reconstructed image and other data from the computer **126**. The operator supplied commands and parameters are used by the computer **126** to provide control signals and information to the DAS **124**, the x-ray controller **122** and the gantry motor controller **123**. In addition, computer **126** operates a table motor controller **134** which controls a motorized table **136** to position the patient **115** in the gantry **112**.

Referring to FIG. **2**, in accordance with the present disclosure, a myocardial CT perfusion (MYOCARDIAL CTP) scan or other CT scan including interventional CT and fluoroscopic CT can be divided into several consecutive partial scans that can be used to track the transient arrival and washout of intravascular contrast agent. Specifically, as illustrated in FIG. **2**, a graph **200** of amplitude **202** versus time **204** during an acquisition of CT imaging data from a subject undergoing motion, such as cardiac motion, provides phase information **206**. A series of partial scans **208** may be used to acquire image data in view angle ranges of, for example, 180 degrees, 180+alpha degrees, and/or 180−alpha degrees; using either single, dual, or multiple x-ray source approach.

In the illustrated non-limiting example, five partial scans are used to acquire the desired medical imaging data. The five partial scans in the example are number one (1) through five (5) and are acquired such that adjacent partial scans have partially overlapping scan regions **210**, **212** but also non-overlapping scan regions **214**, **216**. Accordingly, when combined, an average full set of imaging data **218** is available. The partial scans **208** can improve temporal resolution, but partial scan reconstruction artifacts (PSAs) are observed due to different angular ranges of projections used. In accordance with the present disclosure, a method is provided that does not need to create an artificial full scan or a virtual scan to subtract or add either one to the original measured data. Rather, as will be described, PSR artifact reduction can be achieved by filling the missing data of a partial scan such that a full scan, free from artifact, can be reconstructed. To estimate the remaining 180+/−alpha projection information to complete a full scan, several phase-correlated time neighbor partial scans can be weighted to create a weighted average of temporal neighbors data set **220**.

In accordance with the present disclosure, a method is provided for reducing PSA by filling missing data of a partial scan such that a full scan, free or appreciably free from artifact, can be reconstructed. More specifically, some embodiments of the present disclosure provide an algorithm to estimate the missing data of partial scans so that full scans in the projection space may be created with minimal or zero PSA.

In some methods of the present disclosure, data associated with each partial scan **208** is stored in a matrix called a sinogram that contains x-ray projection values (line integrals) at different view angles and detectors. For example, in a Somatom Definition CT Scanner (Siemens Healthcare, Forchheim, Germany), there are 1152 view angles and 672 detectors. However, as described above, the partial scan projection data collected may only cover an angular range of 180+/−alpha degrees, instead of a full 360 degrees. As a result, projection data may be missing for one or more view angles such that the average full scan **218** is not available.

Referring to FIGS. **3** and **4**, a process for performing a CTP scan, while controlling PSAs will be described. At process block **300** partial scan sinograms expanding 180+alpha angular range are obtained. “Acquiring” or “obtaining” the sinogram data may include performing a scan of a subject using an imaging system such as described above or may include accessing previously-acquired data. Referring to FIG. **4**, the acquision of one partial scan is illustrated at **400**. In this example, data is obtained for each detector element (e.g. 672 detectors) at an initial angle B**1** through an end angle B**2**, where B**2**−B**1**=180+alpha. At process block **302** of FIG. **3**, an empty full-scan sinogram matrix **402** of FIG. **4**, is created expanding from 0 to 360 degrees and across all detector elements, in the above example, spanning 672 detectors.

At process block **304**, a partial scan sinogram at time t_i, with i=1 to N, is moved to a corresponding full-scan sinogram matrix expanding from 0 to 360 degrees. The full scan sinogram matrix is equal to the partial scan sinogram matrix from angular projection data corresponding to angles B**1** to B**2**, and its empty otherwise. This is graphically illustrated in FIG. **4** at **404**.

At decision block **306**, a check is made to determine if all scans have been acquired. If not, the above-described steps are repeated. Thus, the above-described process is repeated for all acquired partial scan sinograms, such as illustrated in FIG. **4** at **406**. As illustrated in FIG. **4**, the partial scan sinogram fills only part of the full-scan sinogram matrix and, for each set of partial scan sinogram data extending over a set of view angles **408**-**414**, is correspondingly aligned in the full scan sinogram matrix **416**-**422**.

The resulting array of matrices has three dimensions, which are view angle, detector index, and time. Following thereafter, at process block **308**, an interpolation or weighting scheme is applied in the temporal dimension, such that the missing data of the sinograms can be estimated. As illustrated in FIG. **4** at **424**, the full-scan sinogram matrix is filled to include data estimated using temporal interpolation or weighting scheme of sinograms. Appropriate interpolation schemes may include but are not limited to linear or cubic splines. Appropriate weighting schemes can be used to average neighboring partial scans by considering both the distance in time (e.g. weighting higher the contributions from partial scans which are closer in time relative to partial scans farther in time), and/or intensity differences (e.g higher weights if attenuation value differences through time are small, and lower weight for the averaging process if difference through time are large). Typical weighting schemes to use can include but are not limited to exponential or linear weights.

As indicated at process block **310** of FIG. **3**, the next step includes image reconstruction. Image reconstruction can be performed using methods such as the filtered backprojection or iterative reconstruction. It is contemplated that only the set of estimated full scan sinograms may be used for reconstruction. That is, the estimated/interpolated/weighted datasets that contained the originally-acquired sinogram and were completed by interpolation or weighting scheme can be used for reconstruction. Accordingly, an image of the subject acquired while undergoing motion can be reconstructed using the estimated medical imaging data and the imaging data from the partial scans that does not suffer from PSAs.

The above method makes uses of several consecutive partial scans such as that described by Stenner. However, only one set of sinograms (instead of 3) needs to be reconstructed. The method can employ a temporal interpolation of the sinograms, but it also can use a weighting scheme. It is targeted to time-series of consecutive partial CT scans such as the ones required in CTP applications to reduce PSAs. Further, because each reconstruction uses a larger number of projections (the estimated ones), the image noise (standard deviation of CT numbers) of reconstructed images is decreased; hence providing higher image quality or providing the possibility to reduce radiation dose. Furthermore, because only partial scans are used, motion artifacts are reduced when compared to full scan data acquisitions.

The methods of the present disclosure do not require further components or systems in addition to currently available CT scanners. For example, in some embodiments, storage of the projection data may occur in the above-described DAS **124** or another component of the control mechanism **120**. In addition, one or more algorithms used to estimate missing sonogram data according to the method described above may be executed by the image reconstructor **125** and/or the computer **126**. As a result, the methods of the present invention can be integrated into current myocardial CTP protocols available in CT scanners.

In testing, the above-described sinogram interpolation method of the present disclosure was able to consistently decrease CT number variations of partial scans to less than 20 percent in a stationary phantom. High temporal resolution was maintained because only partial scans contribute to the final data. Since more photons are used per scan, an extra benefit of the present method is that it can reduce noise by approximately 30 percent.

The systems and methods of the present disclosure are less complex than previous solutions for reducing PSA because they do not require additional x-ray exposures, as in the TSFF method, or the use of an artificial full scans or a virtual scan in addition to the original measured data, as in the Stenner method. In general, the system and methods of the present disclosure may have one or more of the following advantages over previous potential solutions. The methods reduce temporal CT number variations because full scans are estimated. Noise is reduced because more photons are used. Clinicians are provided with greater flexibility, for example, allowing only high temporal resolution contributions to be used for reconstruction. The methods maintain high fidelity in the time-attenuation-curves because the acquired data spanning a partial scan is preserved and only the missing projection data to complete a full scan is estimated with a proper interpolation or weighting method. The process is not computationally burdensome as the mathematics can rely on simple functions, such as exponential and linear functions, or spline interpolation, for the estimation of missing angular projections. The processes are independent of reconstruction parameters employed (e.g., filtered backprojection kernel or iterative reconstruction algorithm) because they are applied in the raw projection data domain. Advantageously, additional scans and radiation dosage are unnecessary because no prior information is needed. The process is compatible with myocardial CTP data acquired with either single or dual-source CT, with the later providing an advantage of faster scanning and, hence, better temporal resolution. Further, the methods disclosed can further increase temporal resolution with multi-segmented contributions lower than 180+alpha.

The present invention has been described in terms of one or more preferred embodiments, and it should be appreciated that many equivalents, alternatives, variations, and modifications, aside from those expressly stated, are possible and within the scope of the invention.

The invention claimed is:

1. A method for producing images of a subject acquired during subject motion using a medical imaging system and partial scan trajectories, the method comprising the steps of:

a) acquiring sinogram data of a subject formed as a series of sets of partial-scan projection views, each set of projection views extending over an angular range of less than 360 degrees from an initial view angle to an end view angle and differing angular ranges between sets in the series of sets of partial scan projection views;

b) creating a full-scan sinogram matrix for each of the sets of projection views in the series;

c) storing each set of partial-scan projection views in a respective full-scan sinogram matrix to create an array of full-scan matrices having respective empty spaces not filled by partial-scan projection view data stored therein;

d) filling the empty spaces in each of the full-scan sinogram matrices using the partial-scan projection view data stored therein; and

e) reconstructing an image of the subject from the full-scan sinogram matrices having the empty spaces filled using the partial-scan projection view data stored therein.

2. The method of claim **1** wherein the full-scan sinogram matrices have dimensions of at least two of view angle, detector index, and time.

3. The method of claim **2** wherein step d) includes applying at least one of an interpolation scheme and a weighting scheme in a temporal dimension to fill the empty spaces.

4. The method of claim **3** wherein weighting scheme uses one of exponential weights and linear weights.

5. The method of claim **3** wherein the interpolation scheme uses one of linear interpolation and cubic splines.

6. The method of claim **1** wherein step d) includes filling only a portion of the empty spaces.

7. The method of claim **1** wherein the medical imaging system includes a computed tomography (CT) system and the subject motion is cardiac motion.

8. The method of claim **7** wherein the set of partial-scan projection views tracks a transient arrival and washout of an intravascular contrast agent within the subject.

9. The method of claim **1** wherein the initial view angle and the end view angle of adjacent sets of partial-scan projection views in the series of sets of partial-scan projection views are offset by a predetermined angle.

10. The method of claim **9** wherein the predetermined angle is selected to create projection views adjacent sets of partial-scan projection views in the series of sets of partial-scan projection views that are both overlapping and non-overlapping.

11. A computed tomography (CT) imaging system comprising:

an x-ray source configured to emit x-rays toward an object to be imaged;

a detector configured to receive x-rays that are attenuated by the object;

a data acquisition system (DAS) connected to the detector to receive an indication of the received x-rays;

a computer system coupled to the x-ray source and DAS and programmed to:

control the x-ray source, detector, and DAS to acquire sinogram data of the object as a series of sets of partial-scan projection views, each set of projection views extending over an angular range of less than 360 degrees to create partially overlapping scan regions and non-overlapping scan regions;

create a full-scan sinogram matrix for each of the sets of the projection views in the series;

store each set of partial-scan the projection views in a respective full-scan sinogram matrix to create an array of full-scan matrices having respective empty spaces not filled by partial-scan projection view data stored therein;

fill the empty spaces in each of the full-scan sinogram matrices using the partial-scan projection view data stored therein; and

reconstruct an image of the subject from the full-scan sinogram matrices having the empty spaces filled using the partial-scan projection view data stored therein.

12. The system of claim **11** wherein the full-scan sinogram matrices have dimensions of at least two of view angle, detector index, and time.

13. The system of claim **12** wherein the computer system is further configured to apply at least one of an interpolation scheme and a weighting scheme in a temporal dimension to fill the empty spaces.

14. The system of claim **13** wherein the computer system is further configured to us a weighting scheme including one of exponential weights and linear weights.

15. The system of claim **13** wherein the computer system is further configured to uses one of linear interpolation and cubic splines.

16. The system of claim **11** wherein the computer system is further configured to fill only a portion of the empty spaces.

17. The system of claim **11** wherein the series of sets of partial scan projection views includes sinogram data acquired from differing angular ranges of projections between sets of partial scan projection view.

18. A method for reducing partial scan reconstruction artifacts in computed tomography images acquired during subject motion using partial scan trajectories, the method comprising:

obtaining at least two sets of medical imaging projection data from a subject undergoing motion using partial computed tomography scans having an associated and differing angular range;

storing the at least two sets of medical imaging projection data in a matrix arranged according to view angle; and

estimating medical imaging projection data in view angles outside the angular range covered by each partial computed tomography scan using at least one of a weighting and an interpolation based on the medical imaging projection data from neighboring partial computed tomography scans.

19. The method of claim **18** wherein the medical imaging projection data at neighboring partial computed tomography scans are weighted by one of exponential weights and linear weights.

20. The method of claim **18** further comprising storing the estimated medical imaging projection data in the matrix with the at least two sets of medical imaging projection data and reconstructing an image of the subject acquired while undergoing motion using the estimated medical imaging projection data and the at least two sets of medical imaging projection data stored in the matrix.

21. The method of claim **18** wherein estimating the medical imaging projection data includes combining consecutive partial scans with a selected weighting factor in a temporal domain.

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